

AMENDMENTS TO THE SPECIFICATION

Please replace paragraph [0002] with the following amended paragraph:

[0002] This application relates to receiving/transmitting radio wave antennas, for example antennas for use in wireless communication, and more specifically to planar antennas such as microstrip antennas and ~~inverted planar F~~ planar inverted-F antennas (PIFAs) that have a slot in the receiving/transmitting radiating element thereof (hereinafter called a radiating element).

Please replace paragraph [0022] with the following amended paragraph:

[0022] In the construction and arrangement of the present invention such an exclusive resonant band is provided wherein the radiating element and the shorted parasitic element are in a common plane. In the present invention (see FIG. 8) a shorted parasitic element is placed within the slot region of the radiating element, and the shorted parasitic is not electrically connected to the radiating element. This co-planar placement of the radiating element and the shorted parasitic element facilitates an easy of fabrication of a single feed multi band PIFA.

Please replace paragraph [0036] with the following amended paragraph:

[0036] A majority of the length of L-shaped slot 11 is of a generally uniform width, as is identified by numeral 16. The vertically extending section 17 of L-shaped slot 11 is linear and extends generally perpendicular to non-radiating edge 13. The horizontally extending section 18 of L-shaped slot 11 follows a meandering path that includes three vertically extending segments 19, 20 and 21. Note that at the location of the three vertically extending segments (19,20,21), L-shaped slot 11 have a greater vertical width, as is indicated by numeral ~~[[22]]~~38.

Please replace paragraph [0076] with the following amended paragraph:

[0076] An additional resonant frequency of the PIFA of FIG. 8 is also realized by forming a meandering metal segment 112 within meandering L-shaped slot 111. In this embodiment of the invention metal segment 112 is connected to the PIFA's ground plane, to thus perform as a shorted parasitic element.

Please replace paragraph [0079] with the following amended paragraph:

[0079] In describing this invention, when placing an extension of the radiating element into the radiating element's slot region it has been assumed that the extension was co-planar with the radiating element. This co-planarity provides for the desirable advantage of a relative ease of fabricating the radiating element.

Please replace paragraph [0081] with the following amended paragraph:

[0081] In such a generalized scenario, only a segment or a part of the extension of the radiating element need extend into or through the slot region so as to be co-planar with the radiating element, and the remainder of the extension can extend into the space that is available between the radiating element and the ground plane of a planar antenna such as a PIFA or a microstrip antenna, for example see the air-dielectric space that exists in FIG. [[9]]10 between the radiating element and the ground plane. Implementation of such a generalized design requires only an area of the slot region that facilitates a continuation of the co planar segment of the extension of the radiating element into the space that exists between the radiating element and the ground plane. With a view to keeping the description of this invention concise, and with a view to avoiding repetition, no further detailed description is required of embodiments of the

invention wherein the metal element that lies within the radiating element's slot includes a portion that is within the space the exists between the radiating element and the ground plane.

AMENDMENTS TO THE CLAIMS

Claim 1 (original): An antenna comprising:

- a ground plane;
- a radiating element spaced above said ground plane;
- a slot having side walls formed in said radiating element; and
- an extension of said radiating element within said slot and out of physical contact with said side walls.

Claim 2 (original): The antenna of claim 1 wherein a portion of said extension is located in a space between said radiating element and said ground plane.

Claim 3 (original): The antenna of claim 1 including:

- a shorting post connecting said radiating element to said ground plane;
- an edge on said radiating element;
- said slot having an open end located on said edge and having a closed end located within said radiating element;
- said extension having a first end connected to said radiating element and located generally adjacent to said open end of said slot; and
- said extension having a second end located generally adjacent to said closed end of said slot.

Claim 4 (original): The antenna of claim 3 wherein said second end of said extension is located in a space between said radiating element and said ground plane.

Claim 5 (currently amended): The antenna of claim 3 wherein said edge is a ~~non-~~
~~radiating~~radiating edge of said radiating element.

Claim 6 (original): The antenna of claim 3 wherein said edge is a non-radiating edge of
said radiating element.

Claim 7 (original): The antenna of claim 6 wherein said shorting post is located
generally on said non-radiating edge of said radiating element.

Claim 8 (original): The antenna of claim 7 including:
a feed post on a non-radiating edge.

Claim 9 (original): The antenna of claim 3 wherein said edge is a radiating edge of said
radiating element and including a feed post on said radiating edge.

Claim 10 (original): The antenna of claim 3 wherein said edge is a generally linear edge,
wherein said slot is a generally L-shaped slot having a first portion that extends generally
perpendicular to said linear edge and a second portion that extends generally parallel to said
linear edge, wherein said extension includes a first portion that extends through said first portion
of said slot, and wherein said extension includes a second portion that extends through said
second portion of said slot.

Claim 11 (original): The antenna of claim 10 wherein said second portion of said extension additionally extends into a space between said radiating element and said ground plane.

Claim 12 (original): The antenna of claim 10 wherein said second portion of said slot meanders in a path that extends generally parallel to said generally linear edge, and wherein said second portion of said extension meanders in a path that extends generally parallel to said generally linear edge.

Claim 13 (original): The antenna of claim 12 wherein said second portion of said extension additionally extends into a space between said radiating element and said ground plane.

Claim 14 (original): The antenna of claim 10 wherein said second portion of said slot is a linear portion that extends generally parallel to said generally linear edge, and wherein said second portion of said extension includes a first portion that extends in one direction through said second portion of said slot, a turn-around portion that is located generally at said closed end of said slot, and a third portion that extends in a second direction through said second portion of said slot.

Claim 15 (original): The antenna of claim 3 wherein said edge is a non-radiating edge of said radiating element, including:

a radiating edge on said radiating element;

a feed post on said radiating edge;

a shorting post on said non-radiating edge connecting said radiating element to said ground plane;

said slot having an open end located on said non-radiating edge and a closed end located within said radiating element;

said extension having a first end connected to said radiating element generally at said open end of said slot; and

said extension having a second end located generally adjacent to said closed end of said slot.

Claim 16 (original): The antenna of claim 15 wherein said slot includes a generally linear portion that extends generally perpendicular to said non-radiating edge, and wherein said extension follows a meandering path as it extends through said linear portion of said slot.

Claim 17 (original): The antenna of claim 16 wherein said slot includes a first generally linear portion that extends generally perpendicular to said non-radiating edge and a second generally linear portion that extends from said first portion of said slot generally parallel to said non-radiating edge, wherein said extension includes a first portion that follows a meandering path as it extends through said first linear portion of said slot, and wherein said extension includes a second portion that extends from said first portion of said extension and follows a generally linear path as it extends through said second portion of said slot.

Claim 18 (original): The antenna of claim 3 wherein said edge is a non-radiating edge of said radiating element, including:

a radiating edge on said radiating element;

a feed post on said radiating edge;

a shorting post on said non-radiating edge connecting said radiating element to said ground plane;

said slot having an open end located on said non-radiating edge and a closed end located within said radiating element;

said extension having a first portion connected to said radiating element generally adjacent to said open end of said slot so as to position a second end of said first portion generally at a middle of a length of said slot; and

said extension having a second portion having a first end connected to said radiating element adjacent to said second end of said first portion, said second portion having a second end located generally adjacent to said closed end of said slot.

Claim 19 (original): The antenna of claim 18 wherein said first and second portions of said extension follow meandering paths.

Claim 20 (original): The antenna of claim 1 wherein said antenna is a planar antenna selected from the group microstrip antenna and planar inverted-F antenna.

Claim 21 (original): An antenna comprising:

a metal ground plane;

a metal radiating element spaced from said ground plane;
a slot having side walls formed in said radiating element; and
a metal element located within said slot and out of physical contact with said side walls.

Claim 22 (original): The antenna of claim 21 wherein said metal element is connected to said ground plane.

Claim 23 (original): The antenna of claim 22 wherein said ground plane and said radiating element are planar members that extend generally parallel to each other, and wherein at least a portion of said metal element is generally coplanar with said radiating element.

Claim 24 (original): The antenna of claim 23 wherein a portion of said metal element lies in a space between said radiating element and said ground plane.

Claim 25 (original): The antenna of claim 23 wherein said radiating element includes an edge, wherein said slot includes a length dimension, a closed end that is located within said radiating element, and an open end that is located on said edge, and wherein said metal element meanders generally along the length of said slot so as to have an effective length dimension that is longer than said length dimension of said slot.

Claim 26 (original): The antenna of claim 25 including:
a shorting post connecting said radiating element to said ground plane.

Claim 27 (original): The antenna of claim 21 wherein said metal element is connected to said radiating element.

Claim 28 (original): The antenna of claim 27 wherein said ground plane and said radiating element are planar members that extend generally parallel to each other, and wherein at least a portion of said metal element is coplanar with said radiating element.

Claim 29 (original): The antenna of claim 28 wherein a portion of said metal element lies in a space between said radiating element and said ground plane.

Claim 30 (original): The antenna of claim 29 wherein said radiating element includes an edge, wherein said slot includes a length dimension, a closed end that is located within said radiating element, and an open end that is located on said edge, and wherein said metal element meanders generally along said length dimension of said slot so as to have an effective length dimension that is longer than said length dimension of said slot.

Claim 31 (original): The antenna of claim 30 including:
a shorting post connecting said radiating element to said ground plane.

Claim 32 (original): The antenna of claim 21 wherein said antenna is selected from the group microstrip antenna and planar inverted-F antenna.

Claim 33 (currently amended): A planar antenna comprising:

a ground plane;

a radiating element having an edge;

a shorting post connecting said radiating element to said ground plane;

a first slot having side walls, an open end that is located on said edge, and a closed end that is located within said radiating element;

a second slot having side walls, an open end that is located on said edge at a position that is spaced from said open end of said first slot, and a closed end that is located within said radiating element;

a first extension of said radiating element entering said first slot at said open end thereof and extending generally along a length of said ~~second~~first slot from said open end to generally said closed end thereof without physically contacting said side walls of said first slot; and

a second extension of said radiating element entering said second slot at said open end thereof and extending generally along a length of said second slot from said open end to generally said closed end thereof without physically contacting said side walls of said second slot.

Claim 34 (original): The antenna of claim 33 wherein said first extension of said radiating element follows a path that is selected from the group linear and meandering, and wherein said second extension of said radiating element follows a path that is selected from the group linear and meandering.

Claim 35 (original): The antenna of claim 34 wherein said antenna is selected from the group microstrip antenna and planar inverted-F antenna.

Claim 36 (currently amended): A method of controlling the operating parameters of a planar antenna comprising the steps of:

- providing a generally planar metal radiating element having an edge;
- providing a slot within said radiating element;
- providing that said slot include side walls, an open slot-end that lies on said edge of said radiating element, and a closed slot-end the lies within said radiating element;~~and~~
- providing a generally planar metal segment;
- providing that at least a portion of said metal segment is coplanar with said radiating element; and
- providing that said metal segment extends generally from said open slot-end to said closed slot-end without physically engaging said side walls.

Claim 37 (original): The method of claim 36 including the step of:

- electrically connecting said metal segment to said radiating element.

Claim 38 (original): The method of claim 36 including the step of:

- electrically connecting said metal segment to said radiating element at a location generally adjacent to said open-end of said slot.

Claim 39 (original): The method of claim 38 including the step of:

- providing said metal segment as a meandering metal segment whose length is greater than a length of said slot.

Claim 40 (currently amended): The method of claim 36 including the steps of:
providing a metal ground plane that is spaced from and generally coplanar-parallel with
said radiating element; and
electrically connecting said metal segment to said ground plane.

Claim 41 (original): The method of claim 40 including the step of:
providing said metal segment as a meandering metal segment whose length is greater
than a length of said slot.

Claim 42 (currently amended): The method of claim 36 including the step of:
providing a metal ground plane that is spaced from and generally coplanar-planar with
said radiating element;
providing that said metal segment is electrically connecting to one of the group radiating
element and ground plane; and
selecting the antenna from the group microstrip antenna and planar inverted-F antenna.

REMARKS

In the specification, paragraphs [0002], [0022], [0076], [0079], and [0081] have been amended to correct minor editorial problems. Paragraphs [0036] and [0081] have been further amended to correct number designations relating to the drawings.

In amended Fig. 1, the indicator directed to a greater vertical width for L-shaped slot 11 has been changed from numeral 22 to numeral 38.

In amended Fig. 10, the figure number designation has been changed from "9" to "10".

Claims 1-42 remain in this application. Claims 5, 33, 36, 40, and 42 have been amended.

Respectfully submitted,

HOLLAND & HART LLP

By: 

Francis A. Sirr, Esq.
Registration No. 17,265
P.O. Box 8749
Denver, Colorado 80201-8749
(303) 473-2700, x2709

Date: 7/14/03

3142054_1.DOC



Annotated Sheet Showing Changes

1/4

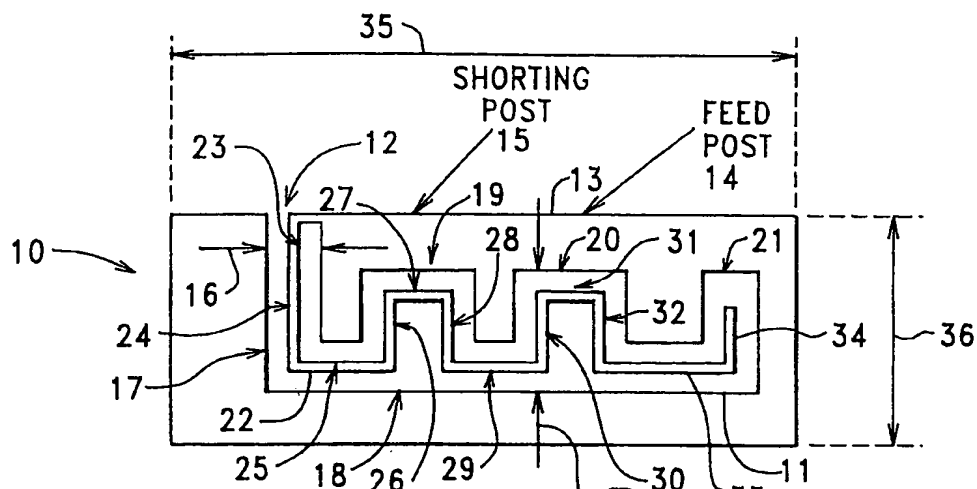


FIG. 1

change to 38

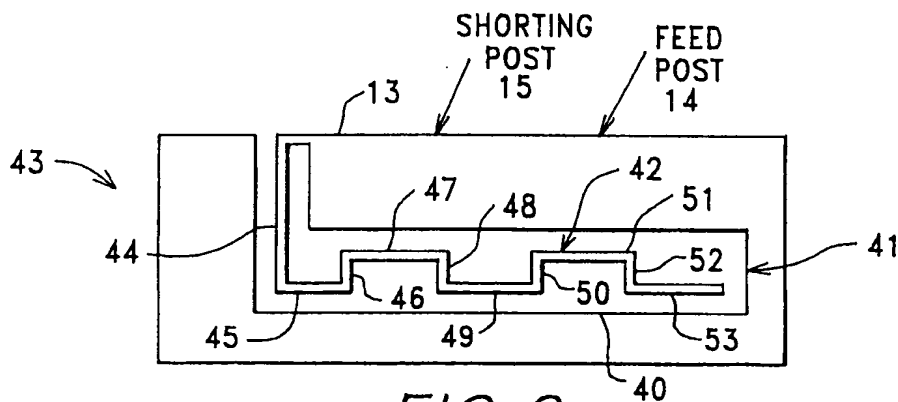


FIG. 2

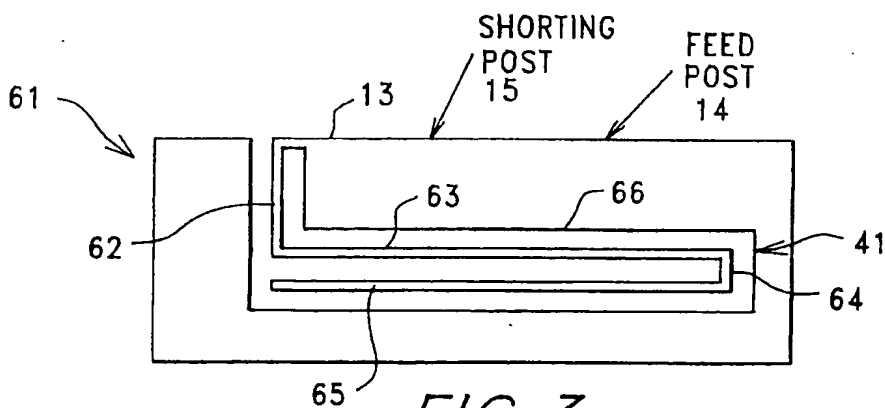


FIG. 3



Annotated Sheet Showing Changes

4/4

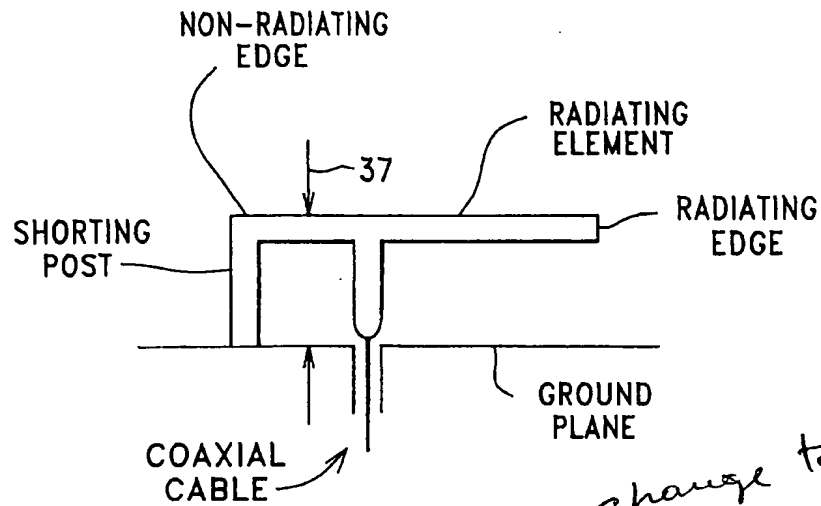


FIG. 9
(PRIOR ART)